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09/557,108	04/24/2000	Jiang Hsieh	15-CT-5344	8980

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EXAMINER	
KIM, CHONG R	

ART UNIT	PAPER NUMBER
2623	

DATE MAILED: 09/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/557,108	HSIEH, JIANG	
	Examiner	Art Unit	
	Charles Kim	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 June 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9,11-13,15-21,23,25-27 and 29-32* is/are rejected.

7)☒ Claim(s) *8,10,14,22,24 and 28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 June 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 23, 2004 has been entered.

Response to Amendment and Arguments

2. Applicant's amendment filed on June 23, 2004 has been entered and made of record.

3. In view of applicant's submitted drawings, the objection to the drawings is withdrawn.

4. Applicant's arguments have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argue (page 5) that claims 30 and 32 are fully supported by the applicant's specification. Applicants state that "at page 7, lines 3-8, configurations are described in which three sampling points are located on both sides of a point x where interpolation is to take place". The Examiner responds by pointing out that page 7, lines 3-8 of the applicant's specification reads:

> "In one embodiment of the present invention, weighted interpolation-extrapolation (W1E), i.e., a combining of weighted interpolation measurements with weighted extrapolated measurements, is used prior to the filtered backprojection. Figure 4 illustrates an example having three sampling points that are located on both sides of a point x where the interpolation is to take place."

Figure 4 illustrates a point X where interpolation/reconstruction takes place. Note that there are only two sampling points (X1 and X2) on the left of point X, and one sampling point (X3) on the right of point X. Accordingly, there appears to be no indication of "more than two conjugate samples that are located on only one side of the curved plane of reconstruction" as recited in lines 4-5 of claim 30. The Examiner was unable to find any other instances in the applicant's specification that supports the claimed features.

Applicants further argue (page 6) that their claimed invention (claims 1-5, 9, 11, 15-19, 23, 25) differs from the prior art because "Nambu discloses a curved plane of projection, which is to be distinguished from a curved plane of reconstruction...The two different planes are totally different in purpose and concept." The Examiner disagrees. Nambu explains that a reconstruction process can be performed on a curved cross section to produce a panoramic curved tomogram (col. 43, lines 3-8). The Examiner notes that the reconstructed panoramic curved tomogram (image) is comprised of at least one projection along a curved plane of reconstruction. **NOTE:** The prior art rejections for claims 1-5, 9, 11, 15-19, 23, 25 would be overcome if the applicants provide sufficient evidence (for example, from an article or text book) indicating the differences between the reconstruction plane of Nambu and the reconstruction plane claimed by the applicant.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 30 and 32 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Referring to claim 30, the phrase "the more than two conjugate samples that are located on only one side of the curved plane of reconstruction" in lines 4-5 is not supported by the applicant's specification. The closest language to this feature appears to be on page 7, lines 13-15 of the applicant's specification, where it states "In one embodiment of the present invention, to use x1 and x2 to estimate x, extrapolation is used as represented by line 52". In this case, it appears that only **two** samples (x1 and x2) used for estimating the at least one projection are located on only one side of the curved plane of reconstruction. Therefore, the applicant's specification does not provide support in regards to "the more than two conjugate samples that are located on only one side of the curved plane of reconstruction" as claimed. A similar rejection is applicable to claim 32.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-5, 9, 11, 15-19, 23, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Taguchi et al., U.S. Patent No. 5,974,108 ("Taguchi") and Nambu et al., U.S. Patent No. 6,196,715 ("Nambu").

Referring to claim 1, Taguchi discloses a method for imaging an object with a computed tomographic imaging system, comprising the steps of:

a. helically scanning the object with a multi-slice CT imaging system to acquire attenuation measurements of the object, the measurements including more than two conjugate samples (col. 4, line 61 to col. 5, line 9. Note that the "groups of real data" in col. 5, line 6 is interpreted as being analogous to more than two conjugate samples; since two data samples are selected from the group, see col. 5, lines 4-6. See also col. 11, lines 48-49), wherein a difference between a view angle of one of the more than two conjugate samples and a view angle of any one of the remaining conjugate samples of the more than two conjugate samples is nΠ, wherein n is an integer greater than zero (col. 10, lines 63-67)

b. estimating at least one projection along a plane of reconstruction of the object using the attenuation measurements of the object, including the more than two conjugate samples [col. 11, lines 48-60 and figure 15. Taguchi explains that the interpolated data is determined using more than two (2n+1) samples, wherein the interpolated data is supplied to the image reconstructor in order to reconstruct (project) the image (col. 12, lines 22-25)]

c. filtering and backprojecting the attenuation measurements of the object, including the more than two conjugate samples, to reconstruct at least one image slice of the object [col. 25, lines 1-12 and col. 26, lines 19-21. Note that the filtering is performed in the interpolator (29) and the backprojecting is performed in the image reconstructor (31) of figure 11].

Taguchi does not explicitly disclose a curved plane of reconstruction. However, this feature was exceedingly well known in the art. For example, Nambu discloses a curved plane of reconstruction for which at least one projection is estimated (col. 35, lines 50-52, col. 43, lines 3-8, and figure 43).

Taguchi and Nambu are both concerned with CT imaging systems. Taguchi is concerned with obtaining a high quality image (Taguchi, col. 4, lines 36-38). Nambu's method suppresses unwanted artifacts in the image, and thereby enhances the image quality (Nambu, col. 3, lines 41-44). Therefore, it would have been obvious to modify Taguchi's plane of reconstruction so that it is a curved plane of reconstruction, as taught by Nambu, in order to enhance the imaging process.

Referring to claim 2, Taguchi further discloses that the more than two conjugate samples are located within a predetermined distance from the plane of reconstruction of the object [col. 2, lines 23-29. Note that the "target slicing location" in line 27 is interpreted to mean the plane of reconstruction, since the image is produced at that location, col. 6, lines 28-30. It is also noted that the samples (arrows) are located within a predetermined distance from the plane of reconstruction (target slicing location) in figure 4B].

Taguchi does not explicitly disclose a curved plane of reconstruction. However, this feature is taught by Nambu, as noted above.

Referring to claim 3, Taguchi further discloses that the CT imaging system has N detector rows (col. 14, line 66), and further comprises the step of selecting a helical pitch P:1 for the helical scan, where P is a non-integer less than N (col. 15, line 33. Note that N=4 and a helical pitch of 2.5 is selected).

Referring to claim 4, Taguchi further discloses that N=4 and P=2.5 (col. 14, line 66 and col. 15, line 33 and figure 26).

Referring to claim 5, Taguchi further discloses a step of applying a non-linear interpolation to the attenuation measurements prior to the filtering and backprojecting (col. 24, lines 34-45 and figure 45).

Referring to claim 9, Taguchi further discloses that applying a non-linear interpolation to the attenuation measurements comprises combining weighted interpolated measurements with weighted extrapolated measurements (col. 11, lines 20-28 and col. 12, lines 12-20).

Referring to claim 11, Taguchi further discloses the step of applying a set of weights to the attenuation measurements prior to the filtering and backprojecting (col. 10, lines 45-57. Note that the weights are applied as the interpolation proceeds in lines 45-46, and is therefore applied prior to the filtering and backprojecting; since the interpolation is applied prior to the filtering and backprojecting as disclosed above).

Claims 15-19, 23, 25 recite a system that corresponds to the method of claims 1-5, 9, 11 respectively. Arguments analogous to those presented above with respect to claims 1-5, 9, 11 are applicable to claims 15-19, 23, 25. The system for performing Taguchi and Nambu's method is inherent in their teaching.

7. Claims 6-7, 12-13, 20-21, 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Taguchi et al., U.S. Patent No. 5,974,108 ("Taguchi") and Nambu et al., U.S. Patent No. 6,196,715 ("Nambu"), further in view of Berlad, U.S. Patent No. 5,513,120 ("Berlad").

Referring to claim 6, Taguchi and Nambu fail to teach applying a Lagrange interpolation.

Berlad teaches a step of applying a Lagrange interpolation to a radiation image (col. 4, lines 1-19).

Taguchi, Nambu, and Berlad are all concerned with image processing systems. Berlad's method provides an interpolated image where the texture of the image does not vary as a function of location and the signal content and signal-to-noise ratio are substantially the same after the interpolation (Berlad, col. 2, lines 16-29). Berlad further explains that the non-linear Lagrange interpolation technique minimizes texture artifacts, thereby producing an accurate interpolated image (Berlad, col. 4, lines 25-44). The ordinary artisan would have been motivated to include the teachings of Berlad in the method of Taguchi and Nambu, in order to reconstruct a radiation image based on an accurate interpolated image, thereby enhancing the resultant radiation image and improving diagnosis. Therefore, it would have been obvious to modify the interpolation of Taguchi and Nambu so that it is a Lagrange interpolation, as taught by Berlad.

Referring to claim 7, Berlad further teaches the step of applying third order Lagrange interpolation weights to a radiation image (col. 4, lines 48-50. Note that the "four interpolation coefficients as derived from a four point cubic Lagrange polynomial" in lines 48-50 is interpreted to mean third order Lagrange interpolation weights).

Taguchi teaches applying a non-linear interpolation to the attenuation measurements from four detector rows (col. 14, line 66 and col. 24, lines 34-45). Therefore, the combination of Taguchi, Nambu, and Berlad teach applying a third order Lagrange interpolation weights to measurements from four detectors.

Referring to claim 12, Taguchi and Nambu fail to teach the step of applying Lagrange weights to the attenuation measurements.

Berlad teaches the step of applying Lagrange weights to a radiation image (col. 48-50. Note that the "four interpolation coefficients" in line 48 is interpreted to mean Lagrange weights).

Taguchi, Nambu, and Berlad are all concerned with image processing systems. Berlad's method provides an interpolated image where the texture of the image does not vary as a function of location and the signal content and signal-to-noise ratio are substantially the same after the interpolation (Berlad, col. 2, lines 16-29). Berlad further explains that the non-linear Lagrange interpolation technique minimizes texture artifacts, thereby producing an accurate interpolated image (Berlad, col. 4, lines 25-44). The ordinary artisan would have been motivated to include the teachings of Berlad in the method of Taguchi and Nambu, in order to reconstruct a radiation image based on an accurate interpolated image, thereby enhancing the resultant radiation image and improving diagnosis. Therefore, it would have been obvious to modify the set of weights of Taguchi and Nambu, so that they are Lagrange weights, as taught by Berlad.

Referring to claim 13, see the rejection of at least claim 7 above.

Claims 20-21, 26-27 recite a system that corresponds to the method of claims 6-7, 12-13 respectively. Arguments analogous to those presented above with respect to claims 6-7, 12-13 are applicable to claims 20-21, 26-27. The system for performing Taguchi, Nambu, and Berlad's method is inherent in their teaching.

8. Claims 29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Taguchi et al., U.S. Patent No. 5,974,108 ("Taguchi") and Nambu et al., U.S. Patent No. 6,196,715 ("Nambu"), further in view of King et al., U.S. Patent No. 5,233,518 ("King").

Referring to claim 29, Taguchi and Nambu fail to explicitly disclose the step of applying interpolation and extrapolation to determine weights to be applied to the attenuation measurements. However, this feature was exceedingly well known in the art. For example, King discloses the step of applying interpolation and extrapolation to determine weights to be applied to attenuation measurements (col. 3, line 61-col. 4, line 2).

Taguchi, Nambu, and King are all concerned with CT imaging systems. King's method reduces skew artifacts in the reconstructed image, thereby enhancing the image reconstruction process (King, col. 3, lines 52-53). Therefore, it would have been obvious to include King's teaching in the method of Taguchi and Nambu, in order to enhance the image reconstruction process.

Referring to claim 31, see the rejection of at least claim 29 above.

Allowable Subject Matter

9. Claims 8, 10, 14, 22, 24, and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles Kim whose telephone number is 703-306-4038. The examiner can normally be reached on Mon thru Thurs 8:30am to 6pm and alternating Fri 9:30am to 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ck
September 23, 2004

Jon Chang
Primary Examiner